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MENTAL PRACTICE IN RELATION TO THE
LEARNING OF RAPID READING SKILLS

by



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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Mental Practice in Relation to the Learning of Rapid Reading Skills" submitted by Jorn Heinz Brauer in partial fulfillment of the requirements for the degree of Master of Education.

On mental practice Galton (1882) wrote:

Our bookish and wordy education tends to repress this valuable gift of nature. A faculty that is of importance in all technical and artistic occupations, that gives accuracy to our perceptions, and justness to our generalizations, is starved by lazy disuse, instead of being cultivated judiciously in such a way as will on the whole bring the best method of developing and utilizing this faculty, without prejudice to the practice of abstract thought in symbols, is one of the pressing desiderates in the yet unformed science of education (p. 79).

ABSTRACT

The purpose of this study was to evaluate the effectiveness of mental practice in learning the skills of rapid reading and to show that mental practice could be as effective in learning these skills as physical practice or a combination of mental and physical practice.

The experiment was conducted with 5 groups: one control group, no practice (NP), and four experimental groups, hand as a pacer (HP), mental practice (MP), physical practice (PP), and mental-physical practice (MP-PP). Eleven hypotheses were formulated to determine significant differences between any of the five groups. Variables of comprehension, vocabulary, and reading rate, as measured by the Nelson-Denny Reading Test (NDRT), were used to formulate the 11 hypotheses.

The subjects were 76 grade eight students attending Westminster Junior High of the Edmonton Public School system. The subjects were randomly selected and randomly assigned to the 5 groups. The experimental groups participated in six sessions, each 45 minutes long, twice weekly for three weeks. Pre and posttest scores for vocabulary, comprehension and reading rate were obtained from the NDRT, Form A and B, for all groups.

The results of the study were in the direction expected and showed that mental practice produced significant improvements in reading rate but not in vocabulary or comprehension.

Other findings indicated that there was no significant difference between any of the four experimental groups when compared to the NP group on the comprehension variable. The HP, PP, and MP-PP groups showed a significant improvement in the vocabulary variable. The combination group of MP-PP showed itself to be superior to the other groups when measured on vocabulary and reading rate. The MP group was as effective as PP or MP-PP in improving reading rate. The groups placed themselves in an expected order when reading rate gain was measured. In ascending order the groups were NP, HP, MP, PP and MP-PP.

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TABLE OF CONTENTS

CHAPTER		PAGE
I	INTRODUCTIONm	1
	The Problem	2
	Definitions	2
	Introduction to the Text	3
II	REVIEW OF RELATED LITERATURE	4
	Introduction	4
	Explanatory Hypotheses for MP	5
	Structure and Number of Groups	7
	Amount of Practice Time	7
	Types of Tasks and Findings	7
	Speed Reading as a Skill	10
	Summary	10
III	METHODS AND PROCEDURES	12
	Hypothesis 1	12
	Hypothesis 2	12
	Hypothesis 3	12
	Hypothesis 4	12
	Hypothesis 5	12
	Hypothesis 6	13
	Hypothesis 7	13
	Hypothesis 8	13
	Hypothesis 9	13

CHAPTER		PAGE
	Hypothesis 10.	13
	Hypothesis 11.	13
	The Subjects	13
	The Research Instrument	14
	The Experimental Design	15
	Administrative Procedures	15
	Analysis of Data	18
IV	PRESENTATION OF THE DATA	19
	The Subjects	19
	Analysis of the Data	19
	Statistical Tests for Hypothesis	21
V	SUMMARY, CONCLUSIONS AND DISCUSSION	33
	Summary	33
	Findings of Posttest	34
	Discussion	35
	Implications	38
	Suggestions for Further Research	39
	SELECTED REFERENCES	40
	APPENDIX A	44

LIST OF TABLES

TABLE		PAGE
I	SUMMARY OF THE ANALYSIS OF VARIANCE FOR VOCABULARY PRETEST SCORES	20
II	SUMMARY OF THE ANALYSIS OF VARIANCE FOR COMPREHENSION PRETEST SCORES	20
III	SUMMARY OF THE ANALYSIS OF VARIANCE FOR READING RATE PRETEST SCORES	20
IV	SUMMARY OF THE ANALYSIS OF VARIANCE FOR POSTTEST SCORES OF VOCABULARY, COMPREHENSION AND READING RATE	22
V	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE NP AND HP GROUPS (Newman-Keuls Method) .	22
VI	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE MP AND PP GROUPS (Newman-Keuls Method) .	22
VII	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE MP AND MP-PP GROUPS (Newman-Keuls Method) .	24
VIII	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE PP AND MP-PP GROUPS (Newman-Keuls Method) .	24

IX	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE NP AND MP GROUPS (Newman-Keuls Method) .	26
X	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE NP AND PP GROUPS (Newman-Keuls Method) .	26
XI	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE NP AND MP-PP GROUPS (Newman-Keuls Method) .	27
XII	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE HP AND MP GROUPS (Newman-Keuls Method) .	27
XIII	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE HP AND PP GROUPS (Newman-Keuls Method) .	29
XIV	COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY AND READING RATE POSTTEST MEASUREMENT FOR THE HP AND MP-PP GROUPS (Newman-Keuls Method) .	29

LIST OF FIGURES

FIGURE		PAGE
1	MATERIAL COVERED IN SPEED READING DRILL	
	NUMBER TWO	17
2	MATERIAL COVERED IN SPEED READING DRILL	
	NUMBER THREE	17
3	PRE AND POSTTEST VOCABULARY MEANS	30
4	PRE AND POSTTEST COMPREHENSION MEANS	31
5	PRE AND POSTTEST READING RATE MEANS	32
6	PRE AND POSTTEST RESULTS FOR VOCABULARY, COMPREHENSION, AND READING RATE FOR ALL GROUPS	36

CHAPTER I

INTRODUCTION

The importance of mental practice on the improvement of a motor skill has been realized in the last 30 years. In activities requiring complicated physical movements, participants go through the motions mentally before the actual physical performance. This process of mentally practicing a task is a familiar everyday experience to many people; however, it has only recently been researched.

The idea that mental practice can improve a motor skill was investigated in 1943 by Vandell, Davis and Clugston. Since then interest in the process of mental practice has focused on its general value in facilitating the initial acquisition of a perceptual motor skill, aiding in the retention of a skill, or in improving the performance of a skill.

Several studies have demonstrated that physical performance of such tasks as the basketball throw and juggling can be improved through mental practice (Beattie, 1946; Twining, 1949; Steel, 1952; Clark, 1960; Start, 1960). Only a few studies were found which investigated the use of mental practice in activities other than those associated with athletics. Two of these investigated mental practice in the retention of maze habits (Sackett, 1935), and digit substitution and card sorting (Perry, 1939).

Speed reading was selected as the task in this study. Thomas (1962) states that "reading is a complex visual-motor task with physical, physiological, psychological and emotional components

(p. 104)." Wood (1962) concluded that reading at rapid rates was a skill that could be broken down into smaller parts and learned one at a time. Several studies by Thomas (1962) and Spache (1962) showed that increased speed in reading depended upon proper eye movement and was greatly facilitated by hand movement.

The Problem

The specific purpose of this study was to investigate the effects of mental practice and physical practice in learning basic speed reading skills.

Definitions

Mental Practice (MP) - refers to the symbolic rehearsal of a physical activity in the absence of any gross muscular movement (Richardson, 1964, p. 148). The subject sits or stands, with eyes closed, and in imagination rehearses the skills.

Physical Practice (PP) - refers to the intervening activity consisting of muscular movement and practice of the skills to be acquired.

No Practice (NP) - is defined as not practicing the skills in any way, nor thinking about them, during the experimental period.

Hand as a Pacer (HP) - is defined as the controlling of sub-conscious regression as well as controlling eye movement by moving the hand across the page just beneath the lines to be read. This group did not practice any of the skills but used their hand as a guide in reading.

Introduction to the Text

The remainder of the thesis consists of the following: Chapter II presents a review of the literature related to the study. Chapter III deals with the specific hypotheses, the research design, administrative procedures and instruments used. Chapter IV includes presentation and interpretation of data. Chapter V presents the results of the study, the conclusions about the hypotheses and the implications for further research.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The belief that the performance of a motor skill can be enhanced by long and strenuous physical practice is probably as old as man himself. The importance of mental practice in the development of a motor skill however, is a relatively recent recognition, gaining prominence only in the last 30 years.

Physical educators have been most active in studying the effects of mental practice. No studies were found which used the aspect of mental practice in acquiring speed reading skills.

The term mental practice (MP) will be used in this study even though the same concept has been referred to by Sackett (1934) as symbolic rehearsal, by Perry (1939) as imaginary practice, by Morrisett (1956) as implicit practice, by Whiteley (1962) as mental rehearsal, by Egstrom (1964) as conceptualizing practice and by Corbin (1967) as covert rehearsal.

The purpose of this chapter is to examine studies in the literature for hypotheses which may explain the effectiveness of MP variables such as structure and number of groups used, amount of practice time allowed, types of tasks performed, and significantly positive or negative findings of the experimental situations, in order to support the methodology used in this study. The latter part of the chapter deals with a limited review of literature which discusses speed reading as a skill.

Explanatory Hypotheses for MP

Many studies have investigated the improvement of various motor skills by mentally practicing the skills to be learned. Following will be several hypotheses which have attempted to explain the reasons for the effectiveness of MP in the learning of a motor skill.

Galton (1883) gave examples of blindfolding chess players who would play seven to eight games at a time:

Free action of a vivid visualizing faculty is of much importance in connection with the higher processes of generalized thought, though it is commonly put to no such purpose. ...the best workmen are those who visualize the whole of what they propose to do before they take a tool in their hands (p. 76).

Orne (1959) and Rosenthal (1963) concluded that demands to perform in an experimental setting may result in increased motivation and thus increased achievement. Richardson (1966, part II) proposed from a review of Steel's (1952) work that:

...the general superiority of the PP group is due primarily to learning and that the difference between the MP and NP groups is due to differences in motivation. The NP group, which is only called on to attend experimental sessions on the first and last day, might well lose some interest in the task, whereas the MP group which attends every day might well be more ego-involved (p. 264).

Corbin (1967) concluded that covert rehearsal effects might be a result of improved confidence, increased relaxation and additional time available to analyze the task.

Familiarity with the task seems to influence the results of MP. Since students remembered something from the instruction sessions, the symbolized skills remained vivid in the subjects' mind, certainly more so than with the NP subjects, who remained completely unfamiliar with the task. Perry (1939), whose task involved digit substitution,

found a high percent gain in performance with the MP group over the NP group but possibly the ease of the task accounted for the very large difference.

MP was effective only with skills which involved symbolic control of movement and more complex skills, such as throwing of darts or balls, were not so easily controlled (Sackett, 1934).

An explanation was given by Richardson (1966) of what occurs in PP when learning a physical skill:

When an object is thrown at a target, visual feedback provides information regarding the degree of deviation and kinesthetic feedback provides information regarding the positions of the body musculature that are associated with varying degrees of deviation. As a result of this information, corrections are made, and the accuracy of subsequent throws gradually increases (p. 266).

Some researchers believe that the PP process occurs internally. Jacobson (1932) and Shaw (1940) demonstrated that MP of a task involved currents in muscle groups which would be used in the actual PP of the task. Jones (1964) stated:

It may be that physical practice, which in the past has been deemed so important, is only concerned with the refinement of movements and that the major part of the mastery of an action is a central process, not a peripheral one (p. 270).

Freeman (1931) indicated that mental work was accompanied by variations in muscular tensions. He found that by photographic registration the muscle groups did thicken during mental work, thus providing valid and important evidence of the spread of neuromuscular activity.

Although the research findings are not conclusive, evidence exists to support the belief that MP is a process which facilitates learning. A physical activity, under certain conditions, can be improved by rehearsing it mentally.

Structure and Number of Groups

The number of groups used in studies investigating the use of MP for the acquisition of a skill varied. Four groups were used in Corbin's (1967) study: NP, PP, MP, and MP and PP. Jones (1964) used only two MP groups under different conditions. The most common number of groups used was three (Perry, 1939; Vandell, Davis & Clugston, 1943; Rohrer, 1949; Twining, 1949; Steel, 1952; Clark, 1960; Kelsey, 1961; Start & Richardson, 1964; Corbin, 1966). These groups were identified as NP, PP and MP.

The selection of subjects was usually at random from a larger parent population or was based on an evaluation of initial performance. The number of subjects varied from as few as four per group (Vandell, Davis & Clugston, 1943) to as many as 72 per group (Clark, 1960).

Amount of Practice Time

The time occupied in MP per session ranged from one minute (Perry, 1939), five minutes (Start, 1964; Trussell, 1952), fifteen minutes (Whiteley, 1962), to thirty minutes (Vandell et al., 1943). Twining's study (1949) suggests that five minutes may be the maximum practice time advisable for MP without a rest period.

Types of Tasks and Findings

Some of the earlier researchers (Jacobson, 1932; Sackett, 1934, 1935; and Shaw, 1940), experimented with the variable of MP. Both Jacobson and Shaw reported that MP excited the nervous system and that actual muscle contractions were evidenced when an individual imagined performing a motor task. Sackett's (1934, 1935) studies with

symbolic rehearsal to determine the influence upon the retention of a maze habit, worked from the basis that rehearsal of memory materials is beneficial to their retention. The conclusion was that both thinking and drawing appeared better than just thinking, but the differences were not significant.

One of the more frequent motor skills to be learned was the basketball throw. Vandell et al. (1943) conducted a study in which subjects imagined themselves as performing the simple skills of basketball shooting and dart throwing. All three groups NP, MP, and PP in both experiments were given initial physical trials. The NP group refrained then from any further trials. The MP and PP groups had eight practice sessions. Vandell et al. (1943) concluded that daily directed PP and MP tended to improve the performance of that skill. Beatty (1946) replicated and confirmed the Vandell et al. study using larger groups.

Two studies, Clark (1960) and Start (1960) using the basketball throw as a skill to be learned, attempted to equate as many variables as possible. Clark (1960) tested for arm strength, intelligence and experience. His findings indicated that increase in familiarity with a task decreased the advantage of PP over MP. However, with novices PP was almost twice as valuable as MP, but MP became as valuable as PP for experienced members. Intelligence did not seem to be a factor influencing MP learning.

Start (1960) also tested for the possible effect of intelligence on MP in learning the underarm basketball free throw and found that MP was not significantly influenced by intelligence. Three groups of

boys were tested and classified in above average, average, and poor in "games ability." There was significant improvement in the mean average final score over the mean average initial score of the group, after MP.

When using a juggling task, Trussell (1952), Corbin (1966, 1967) concluded that MP alone did not improve the skill level. By examining college women in juggling of tennis balls, Trussell also concluded that short MP periods were better than longer periods of MP.

After exposing his subjects to controlled actual practice of a difficult juggling task for one week prior to dividing them into NP, MP, and PP groups, Corbin (1966) concluded that MP, within the limits of the experiment, was not effective in developing skilled motor performance and that actual experience at the task might be necessary if MP was to be a variable in skill development. In 1967 Corbin designed a study "to investigate the effects of covert rehearsal and combined over-covert rehearsal as compared to overt rehearsal in the development of a complex motor skill (p. 145)." The task was wand juggling and the results indicated as before that MP did not improve the skill level.

Jones (1964) found that subjects without previous experience in gymnastic skill could learn basic body skills of that activity using MP, and found that MP without direction was superior to MP with direction, in learning the gymnastic skill.

Investigating the skill of ring tossing by MP as compared to PP, Twining (1949) used 36 college men. It appeared that both the MP and PP facilitated the learning of a motor skill, with PP showing the superior improvement.

Steel (1952) closely followed the design of Twining's (1949) study, but used a basketball accuracy throw as the task. His groups were equated on intelligence, physique, age and motor ability. He found significant improvement in the skilled motor performance with the MP and the PP groups, but no improvement with the NP group.

In three studies the results showed that an alternation of PP and MP produced the greatest improvement in performance (Riley & Start, 1960; Whiteley, 1962; Egstrom, 1964).

Speed Reading as a Skill

Most of the reported literature investigated the Wood Reading Dynamic Method, which is similar to the method of speed reading used in the present study (Brooks, 1926; Harris, 1961; Thomas, 1962; Spache, 1962).

The skill of reading was found to be dependent on proper eye movement and could be improved by developing proper hand-eye coordination (Thomas, 1962; Spache, 1962; Wood, 1962; Liddle, 1966; Tinker, 1966).

Summary

Although some studies suffered from a variety of methodological inadequacies, most studies indicated that MP procedures result in improved performance on the task. Statistically significant positive findings were obtained in ten studies (Perry, 1939; Rubin-Rabson, 1941; Steel, 1952; Beattie, 1946; Clark, 1960; Kelsey, 1961; Smith & Harrison, 1962; Whiteley, 1962; Egstrom, 1964, Corbin, 1966).

Other studies showed a positive trend (Sackett, 1934; Vandell, Davis & Clugston, 1943; Halverson, 1949, Twining, 1949; Harby, 1952; Steel, 1952; Abelskaya & Surkov, 1959) .

Four studies reported negative findings and did not substantiate the belief that MP alone can improve learning of a gross motor skill (Ammons, 1951; Gilmore & Stolurow, 1951; Trussell, 1952; Corbin, 1966) .

The results of the investigations dealing with MP in the learning of a motor skill were for the most part positive and researchers concluded that MP does play an important part in learning.

CHAPTER III

METHODS AND PROCEDURES

The following hypotheses were formulated to test the learning of speed reading skills as achieved under NP, HP, MP, PP, and MP-PP conditions. The .05 level was designated as the level of significance for rejection of the null hypothesis.

Hypothesis 1

Ho: There will be no significant differences among the treatments.

If hypothesis 1 is rejected the following hypotheses will be tested.

Hypothesis 2

There will be no significant difference between the NP and HP groups.

Hypothesis 3

There will be no significant difference between the MP and the PP groups.

Hypothesis 4

There will be no significant difference between the MP and the MP-PP groups.

Hypothesis 5

There will be no significant difference between the PP and the MP-PP groups.

Hypothesis 6

There will be no significant difference between the NP and the MP groups.

Hypothesis 7

There will be no significant difference between the NP and the PP groups.

Hypothesis 8

There will be no significant difference between the NP and the MP-PP groups.

Hypothesis 9

There will be no significant difference between the HP and the MP groups.

Hypothesis 10

There will be no significant difference between the HP and the PP groups.

Hypothesis 11

There will be no significant difference between the HP and the MP-PP groups.

The Subjects

The subjects were 85 grade eight boys and girls at Westminster Junior High School, Edmonton. The 85 subjects were randomly chosen to form five groups by selecting names from a hat. Each group originally

consisted of 17 members. The five groups were randomly selected for the NP, HP, MP, PP and MP-PP designations. Nine subjects did not complete the posttest and therefore were rejected in the analysis of the data. This left 76 subjects distributed as follows: NP - 17 members, HP - 16 members, PP - 15 members, MP - 14 members and MP-PP - 14 members.

The Research Instrument

The Nelson-Denny Reading Test, Revised Edition (NDRT) measured reading ability in terms of vocabulary, comprehension and reading rate. Two comparable forms of the test were used: Form A for the pretest and Form B for the posttest. Both forms of the test were composed of 100 items for measuring vocabulary, 36 items for measuring comprehension and reading rate was determined by calculating the number of words read in one minute.

The actual testing time involved in administration of the NDRT was ten minutes for vocabulary, nineteen minutes for comprehension and one minute for reading rate.

The reliability coefficient as reported by David B. Orr (Buros, 1965) for reading rate and vocabulary was .92 and for comprehension was .81. For vocabulary, the validity test item mean was 47.5 on Form A and 47.4 on Form B. For comprehension items the validity mean for Form A was 44.6 and for Form B was 45.3. The norms were based on scores of more than 21,000 school students from grades 9 to 16. Although the subjects used in this study were grade eight students, the study was not conducted until early spring when the subjects were

well into the second half of grade eight. It was also felt that the tests high ceiling made it particularly suitable as a measuring device for rapid reading rates.

The Experimental Design

The experimental groups participated in six sessions, each 45 minutes long, twice weekly for a three week period. Form A of the NDRT was administered to all groups in the first session as a pretest in order to afford a second check on random sampling and Form B of the NDRT was given to all groups in the final session as the posttest to determine group differences.

Administrative Procedures

The NP group was given the pre and posttest on the first and last day respectively of the experimental period. In the intervening period the members of this group participated in their regular school work and received no instruction or practice in speed reading skills.

The HP group was an experimental group set up to isolate the hand as a pacer factor. This group was also tested in the first and last session of the experimental period. The only instruction given this group was for them to read for five minutes each session using their hand as a guide while reading, by moving their hand along the page under the material being read. No other instructions were given. The five minute period was approximately the amount of practice time the MP, PP and MP-PP groups spent each session using the hand as a pacer to read.

Certain common procedures were applied to the three experimental groups, MP, PP and MP-PP. Each of these groups on day two were given a demonstration on the use of the hand as a pacer. The importance of hand-eye coordination was explained with the help of prepared transparencies. Three basic drills were used to teach speed reading and the hand was used as a pacer in all three drills.

The first drill consisted of reading for one minute and then counting the number of lines read. The students were then instructed to try to cover the same material in progressively less time: $3/4$ of a minute, $1/2$ a minute and $1/4$ of a minute. The MP group was allowed to read for the first minute and then were asked to close their eyes and to imagine successfully covering the same material in the three shorter time periods, using the hand-eye coordination technique in their mental practice. The PP group practiced the drill by covering the same material in less time by actually reading the material and physically using the hand-eye method. The MP-PP group alternated mental and physical practice sessions of the various parts of all drills. In drill one the MP-PP group first practiced physically for one minute, mentally for $3/4$ of a minute, physically for $1/2$ a minute and then mentally for $1/4$ of a minute. The next time this drill was introduced, the part previously practiced physically was practiced mentally, and that which was practiced mentally was repeated physically.

Drill two consisted of reading for one minute using the hand as a pacer, and then repeating the drill three times. Each repetition had a new material addition of 100% of that covered in the first trial,

as shown in Figure 1. Only one minute was allowed for each trial.

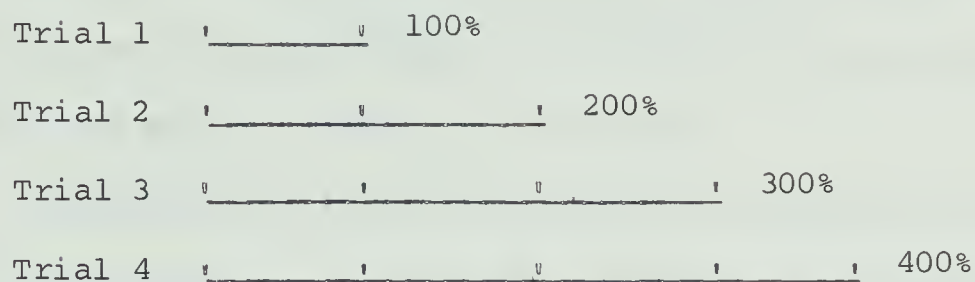


FIGURE 1

MATERIAL COVERED IN SPEED READING
DRILL NUMBER TWO

As in drill one, the MP group was allowed to physically practice the drill once and then the additional trials were mentally practiced. The PP group practiced all trials physically. Again the MP-PP group alternated mental and physical practice on each trial.

The third drill consisted of reading for one minute and then, for each additional trial, previously read material was dropped at a rate equivalent to 50% of the material covered on the first reading, while new material, equivalent to 100% of the original material, was added. This procedure is outlined in Figure 2. This drill was repeated three times with only one minute allowed for each trial.

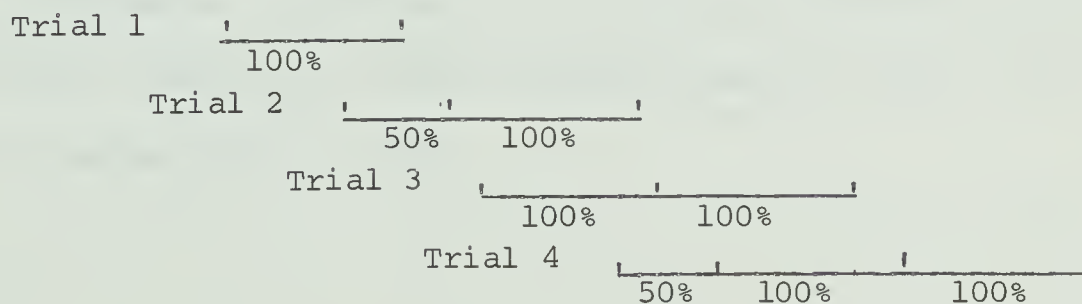


FIGURE 2

MATERIAL COVERED IN SPEED READING
DRILL NUMBER THREE

The MP group practiced physically on the first trial and then mentally visualized the three additional trials. The PP group practiced all trials on the drill physically. The MP-PP group again alternated physical and mental practice on the trials.

During each of the four intervening practice sessions between the pre and posttests, the PP, MP and MP-PP groups managed to practice each drill twice. Between each drill all the subjects were asked to read physically, using the hand as a pacer, for one minute, giving them a total of 5 minutes additional reading time each session. For their own records, the students calculated their reading rates on this fifth one minute trial each session.

Analysis of Data

As a second check that there was initially no significant difference among all five groups with randomly selected members, a one way analysis of variance was carried out on the results of the pretest (NDRT, Form A). A one way analysis of variance was also carried out on the posttest (NDRT, Form B) results in order to establish if there was a significant difference between the group means after the experimental treatment. When the analysis of variance showed differences significant at the .05 level between groups, Newman-Keuls comparison between ordered means was used to test for critical values (Winer, 1962).

CHAPTER IV

PRESENTATION OF THE DATA

This chapter presents the data collected during this study. The hypotheses as stated in Chapter III were tested and the findings presented in tabular form. Differences which did discriminate at the .05 level were noted in the tables by a single asterick. Differences between pretest and posttest means of the three variables will be presented in graph form.

The Subjects

The initial design involved the attainment of NDRT, Form A and B, scores from each of 85 grade eight students before and after the three week experimental period. Complete responses in the posttest administration of the NDRT (Form B) could not be obtained for nine subjects, one in the HP group, two in the PP group, three in the MP group and three in the MP-PP group, and were therefore dropped from the study.

Analysis of the Data

To analyze the data the mean score of each group, for each of the three variables, was compared with the mean score of every other group. Raw scores were used for the comparisons.

The pretest was administered as a second check to random selection procedures. There were no significant differences among the five groups in vocabulary, as is shown in Table I, in comprehension, as shown in Table II, or in reading rate, as shown in Table III.

TABLE I

SUMMARY OF THE ANALYSIS OF VARIANCE
FOR VOCABULARY PRETEST SCORES

SOURCE	SUM OF SQUARES	MEAN SQUARE	d.f.	F	P
Groups	296.02	74.01	4.	0.99	0.42
Error	5288.23	74.48	71.		

$P < .05$

TABLE II

SUMMARY OF THE ANALYSIS OF VARIANCE
FOR COMPREHENSION PRETEST SCORES

SOURCE	SUM OF SQUARES	MEAN SQUARE	d.f.	F	P
Groups	786.50	196.63	4.	2.08	0.09
Error	6685.50	94.16	71.		

$P < .05$

TABLE III

SUMMARY OF THE ANALYSIS OF VARIANCE
FOR READING RATE PRETEST SCORES

SOURCE	SUM OF SQUARES	MEAN SQUARE	d.f.	F	P
Groups	12789.00	3197.25	4.	0.72	0.58
Error	314903.00	4433.84	71.		

$P < .05$

Statistical Tests for Hypothesis

Hypothesis 1: There will be no significant difference among the treatments.

The results of the one way analysis of variance are shown in Table IV. As indicated, Hypothesis 1 was rejected for vocabulary and reading rate. For comprehension, however, this hypothesis was accepted.

Since differences were significant for vocabulary and reading rate, Hypotheses 2 to 11 were tested for these two variables. Newman-Keuls comparison between ordered means was applied to the data. The differences between the means of the groups were declared significant at the 5 percent level.

Hypothesis 2: There will be no significant difference between the NP and the HP groups.

As Table V indicates there was a significant difference between the NP and HP groups' vocabulary means and therefore the null hypothesis was rejected. For reading rate means, however, Table V indicates that there was no significant difference between the NP and the HP groups and therefore the null hypothesis was accepted.

Hypothesis 3: There will be no significant difference between the MP and the PP groups.

Differences were shown to be not significant in Table VI for both vocabulary and reading rate variables and therefore this hypothesis was accepted.

TABLE IV

SUMMARY OF THE ANALYSIS OF VARIANCE FOR POSTTEST SCORES
OF VOCABULARY, COMPREHENSION AND READING RATE

SOURCE OF VARIATION	SUM OF SQUARES	MEAN SQUARE	d.f.	F	P
Vocabulary Post for Comparisons of Means	.90	225.65	4	2.82	.03*
Comprehension Post for Comparisons of Means	.98	246.89	4	2.30	.06
Reading Rate Post for Comparisons of Means	.84	211312.50	4	8.49	.000013*

*P < .05

TABLE V

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE NP AND HP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} NP	\bar{X} HP	\bar{X} NP - \bar{X} HP
Vocabulary	21.59	29.94	8.35*
Reading Rate	278.59	393.25	114.66

*Throughout this thesis a single asterisk is used to denote significance at the .05 level.

TABLE VI
COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE MP AND PP GROUPS
(Newman-Keuls' Method)

VARIABLE	\bar{X} MP	\bar{X} PP	\bar{X} MP - \bar{X} PP
Vocabulary	26.50	29.80	3.30
Reading Rate	503.43	530.20	26.77

Hypothesis 4: There will be no significant difference between the MP and the MP-PP groups.

As Table VII indicates no significant difference was found between the means of the MP and the MP-PP groups for vocabulary or reading rate. The hypothesis was therefore accepted.

Hypothesis 5: There will be no significant difference between the PP and the MP-PP groups.

As Table VIII indicates, no significant difference was found between the means of the PP and the MP-PP groups for vocabulary or reading rate. The hypothesis was therefore accepted.

Hypothesis 6: There will be no significant difference between the NP and the MP groups.

In the comparison of the NP mean and the MP mean in the Post-test vocabulary measurement, there was no significant difference

TABLE VII

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE MP AND MP-PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} MP	\bar{X} MP-PP	\bar{X} MP - \bar{X} MP-PP
Vocabulary	26.50	30.43	3.93
Reading Rate	503.43	556.79	53.36

TABLE VIII

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE PP AND MP-PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} PP	\bar{X} MP-PP	\bar{X} PP - \bar{X} MP-PP
Vocabulary	29.80	30.43	.63
Reading Rate	530.20	556.79	26.59

between the two groups, as indicated in Table IX and the research hypothesis was accepted for this variable. There was, however, a significant difference between the NP mean and the MP mean in the posttest reading rate measurement, as shown in Table IX. The hypothesis was therefore rejected for this variable.

Hypothesis 7: There will be no significant difference between the NP and the PP groups.

The comparison of the means of the posttest for vocabulary and reading rate for the NP and the PP groups showed, as indicated in Table X, that there was a significant difference. Therefore the hypothesis was rejected.

Hypothesis 8: There will be no significant difference between the NP and the MP-PP groups.

There was a significant difference between the NP and MP-PP means for the variables vocabulary and reading rate, as indicated in Table XI. The hypothesis was as a result rejected.

Hypothesis 9: There will be no significant difference between the HP and the MP groups.

As Table XII indicates there was no significant difference between the means of HP and MP groups for the vocabulary. For reading rate there was a significant difference and the hypothesis was supported and accepted.

Hypothesis 10: There will be no significant difference between the HP and the PP groups.

TABLE IX

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE NP AND MP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} NP	\bar{X} MP	\bar{X} NP - \bar{X} MP
Vocabulary	21.59	26.50	4.91
Reading Rate	278.59	503.43	224.84*

TABLE X

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE NP AND PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} NP	\bar{X} PP	\bar{X} NP - \bar{X} PP
Vocabulary	21.59	29.80	8.21*
Reading Rate	278.59	530.20	251.61*

TABLE XI

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE NP AND MP-PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} NP	\bar{X} MP-PP	\bar{X} NP - \bar{X} MP-PP
Vocabulary	21.59	30.43	8.84*
Reading Rate	278.59	556.79	278.20*

TABLE XII

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE HP AND MP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} HP	\bar{X} MP	\bar{X} HP - \bar{X} MP
Vocabulary	29.94	26.50	3.44
Reading Rate	393.25	503.42	110.18*

Table XIII indicates that a comparison of the means of the post-test for vocabulary for the HP and PP groups showed that there was no significant difference between the two groups. The hypothesis was accepted for this variable.

For the HP and the PP groups the reading rate variable showed, when means were compared, that there was a significant difference between the groups as shown in Table XIII. The hypothesis was not supported for this variable and therefore was rejected.

Hypothesis 11: There will be no significant difference between the HP and the MP-PP groups.

As Table XIV indicates there was no significant difference for the comparison of means for the vocabulary variable for the HP and the MP-PP groups. The hypothesis was accepted for this variable.

There was a significant difference between the HP and the MP-PP groups for the reading rate variable as shown in Table XIV. The hypothesis was rejected.

The direction of change is illustrated graphically for the group means from pretest to posttest for each treatment group: Figure 3 for the vocabulary variable, Figure 4 for the comprehension variable, and Figure 5 for the reading rate variable.

TABLE XIII

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE HP AND PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} HP	\bar{X} PP	\bar{X} HP - \bar{X} PP
Vocabulary	29.94	29.80	.14
Reading Rate	393.25	530.20	136.95*

TABLE XIV

COMPARISON BETWEEN ORDERED MEANS OF VOCABULARY
AND READING RATE POSTTEST MEASUREMENT
FOR THE HP AND MP-PP GROUPS
(Newman-Keuls Method)

VARIABLE	\bar{X} HP	\bar{X} MP-PP	\bar{X} HP - \bar{X} MP-PP
Vocabulary	29.94	30.43	.49
Reading Rate	393.25	556.79	163.54*

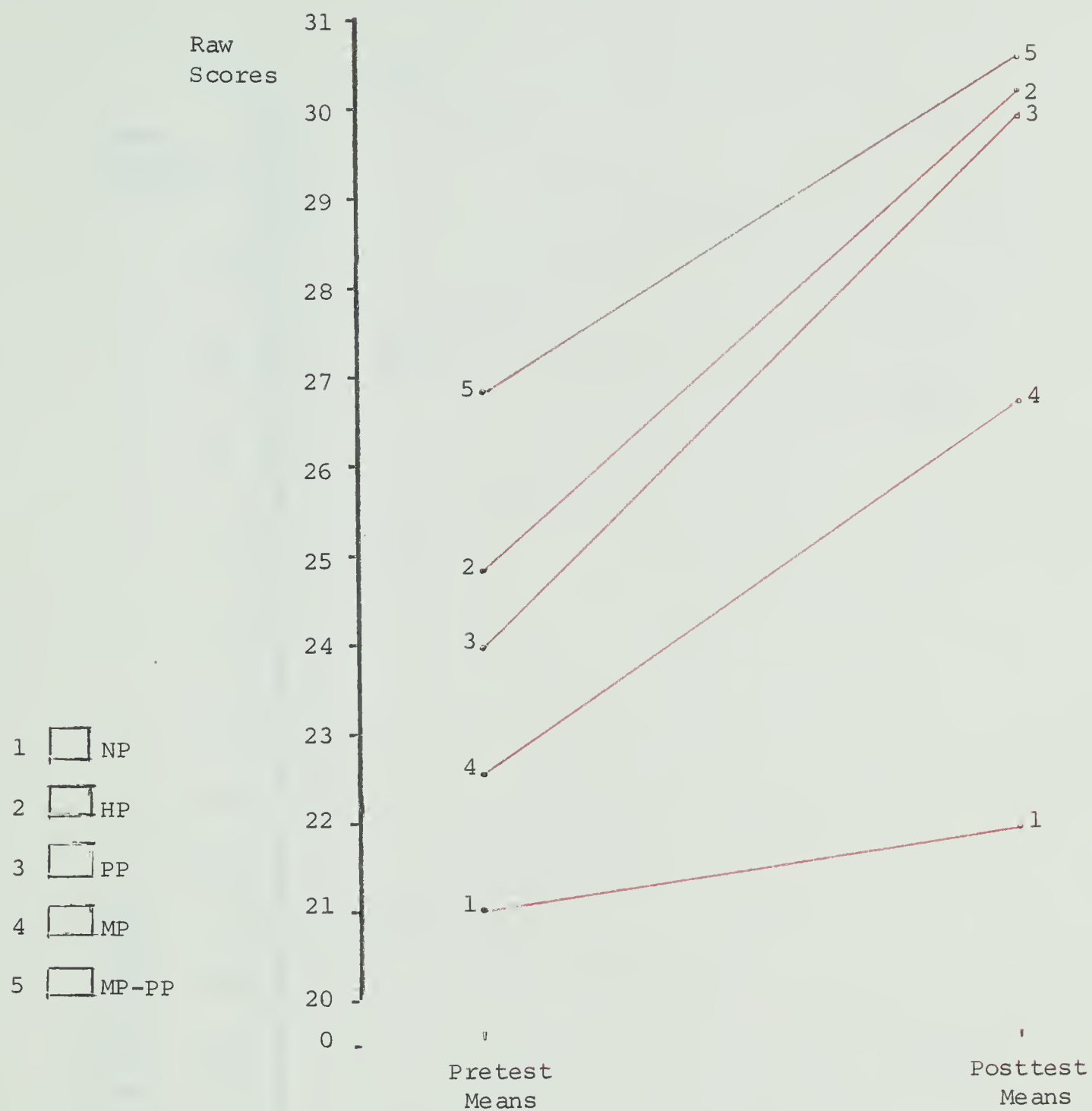


FIGURE 3

PRE AND POSTTEST VOCABULARY MEANS

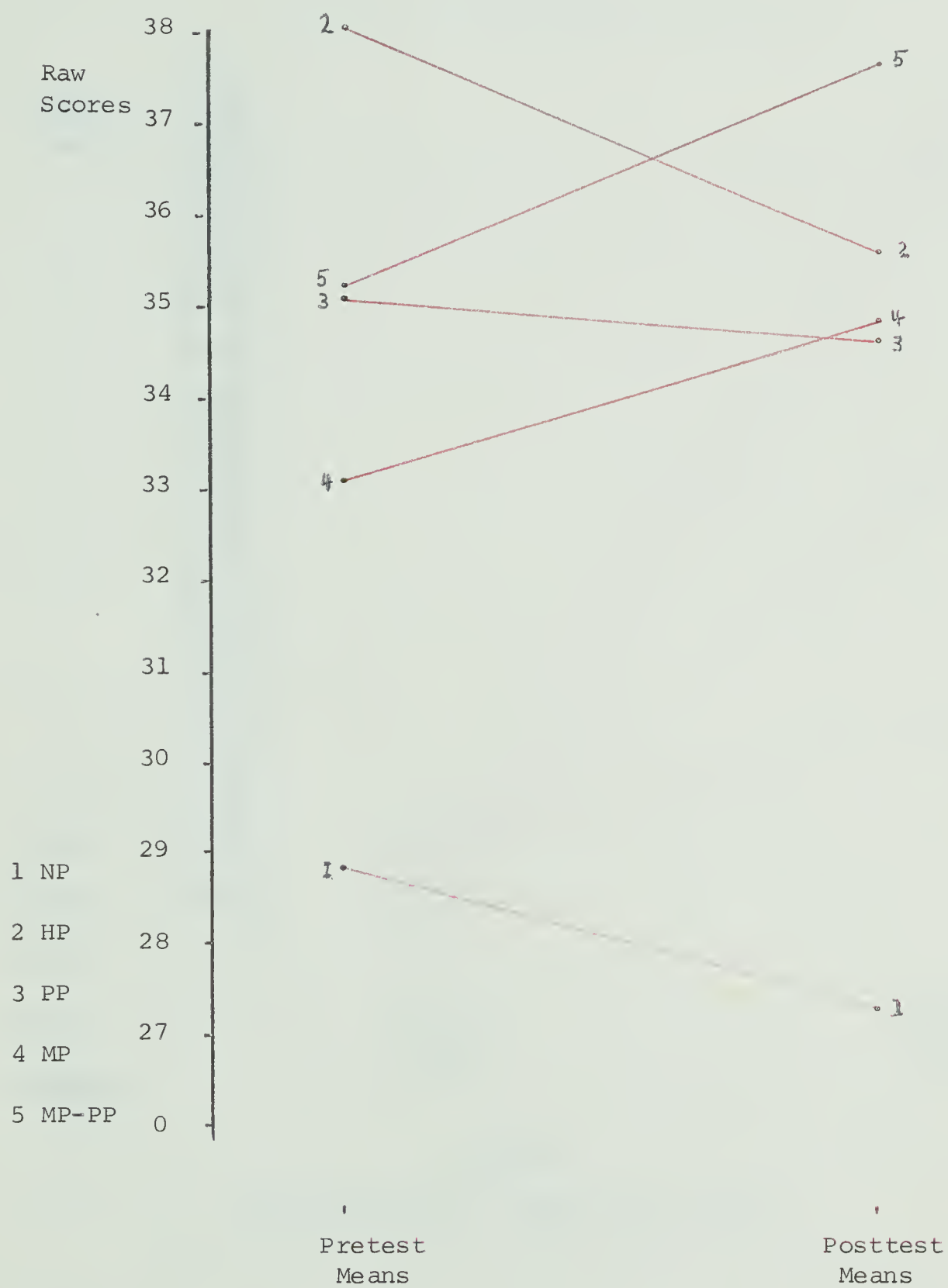


FIGURE 4

PRE AND POSTTEST COMPREHENSION MEANS

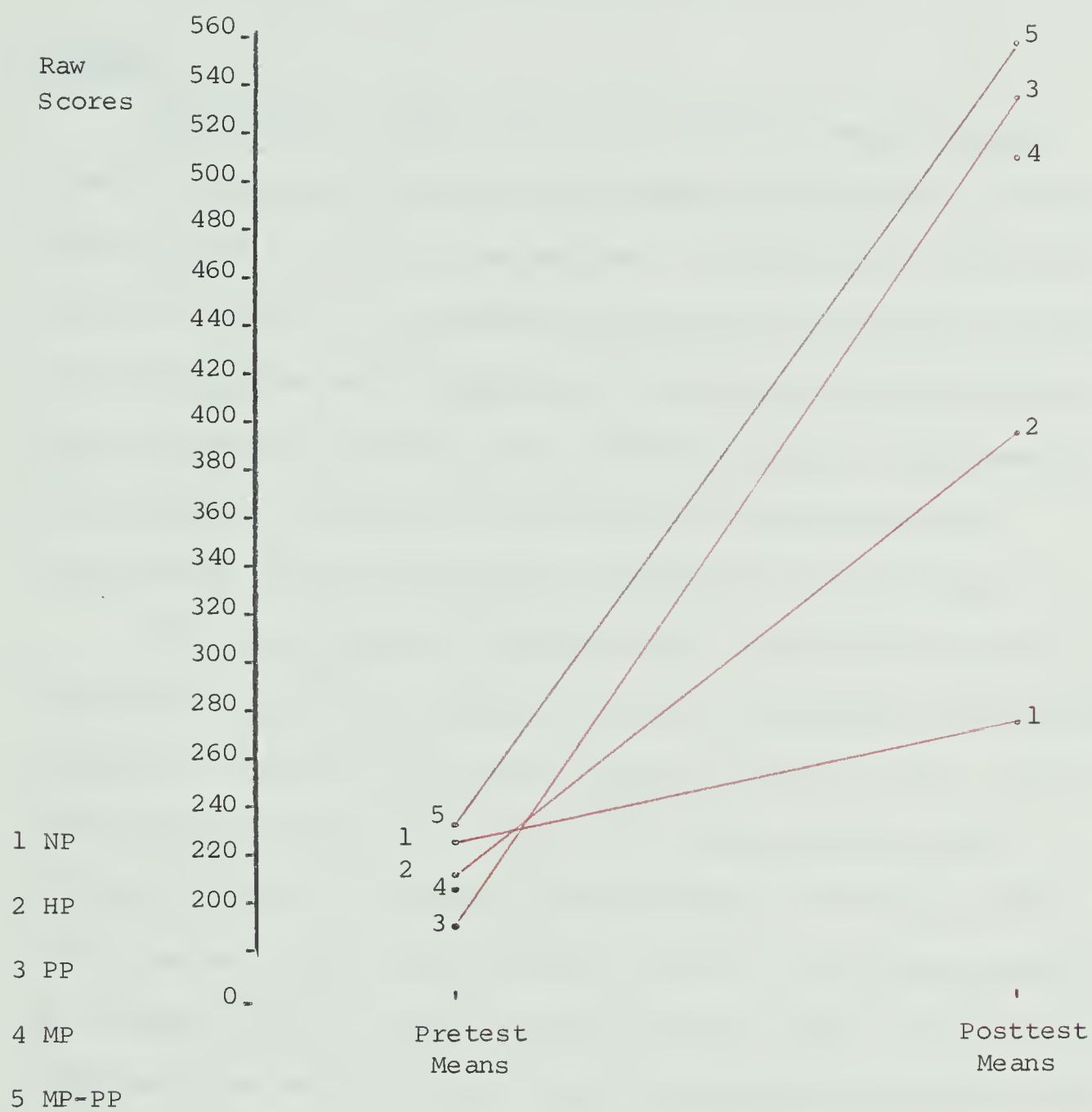


FIGURE 5

PRE AND POSTTEST READING RATE MEANS

CHAPTER V

SUMMARY, CONCLUSIONS AND DISCUSSION

Summary

The purpose of this study was to find out whether mental practice can improve the learning of speed reading skills and that mental practice could be as effective in learning these skills as physical practice or a combination of physical and mental practice. Eleven hypotheses were formulated to test for significant differences between any of the 5 groups. Three variables, comprehension, vocabulary and reading rate, as measured by the Nelson-Denny Reading Test (NDRT), were used to formulate the 11 hypotheses.

The subjects were 76 students from a grade eight population in Westminster Junior High School, Edmonton. The subjects were assigned randomly to 5 groups: one control group, No Practice (NP), and four experimental groups, Hand as Pacer (HP), Mental Practice (MP), Physical Practice (PP), and Mental Practice-Physical Practice (MP-PP). All groups were administered the NDRT, Form A, at the first session as a second check on random selection, and the NDRT, Form B, at the sixth and final session of the three week experimental period as the posttest, to determine differences in comprehension, vocabulary and reading rate between groups.

To test the hypotheses, use was made of the IBM 360/67 computer facilities at the University of Alberta. To test for the significance of differences between the group means on the posttest results for

each variable, a one way analysis of variance was performed. Further analysis consisted of Newman-Keuls method to test for differences between ordered means.

Findings of Posttest

1. There was a significant difference among the treatment groups for vocabulary and reading rate variables but not for comprehension.
2. The HP group mean for vocabulary was significantly greater than the NP group mean, but for reading rate, although the HP group showed a greater improvement than the NP group, the difference was not significant.
3. There was no significant difference between the MP and PP group means for vocabulary or reading rate.
4. There was no significant difference between the MP and MP-PP group means for vocabulary or reading rate.
5. There was no significant difference between the PP and MP-PP group means for vocabulary or reading rate.
6. There was practically no increase in the performance of the NP group in vocabulary or reading rate while the MP group showed improvement in both variables. The difference, however, between the NP and MP group means for vocabulary was not significant but the difference was significant for reading rate.
7. The PP group mean for vocabulary and for reading rate was significantly greater than the NP group mean.

8. The MP-PP group mean for vocabulary and for reading rate was significantly greater than the NP group mean.

9. There was no significant difference between the HP and MP group means for vocabulary. The performance of the MP group was superior to the HP group in reading rate and the difference was significant.

10. The PP group mean for reading rate was significantly greater than the HP group mean but there was no significant difference between the HP and PP group means for the vocabulary variable.

11. The MP-PP group mean for reading rate was significantly greater than the HP group mean, but for vocabulary, although the MP-PP group performance was superior, it was not significantly better than the HP group.

Discussion

None of the experimental treatments showed a significant difference in comprehension when compared to the NP control group. When reading rate is increased and more material is covered the comprehension does not necessarily increase or decrease. Tinker (1962) found that when reading rate improved, comprehension was maintained at an adequate level or decreased with greater emphasis on speed.

In this study there was a small decrease in comprehension from pretest to posttest for the NP, HP, and PP groups and a slight increase for the MP and the MP-PP groups. (Figure 6). The slight increase in comprehension for the MP and MP-PP groups may be due to the mental practice itself which could have contributed to better organization

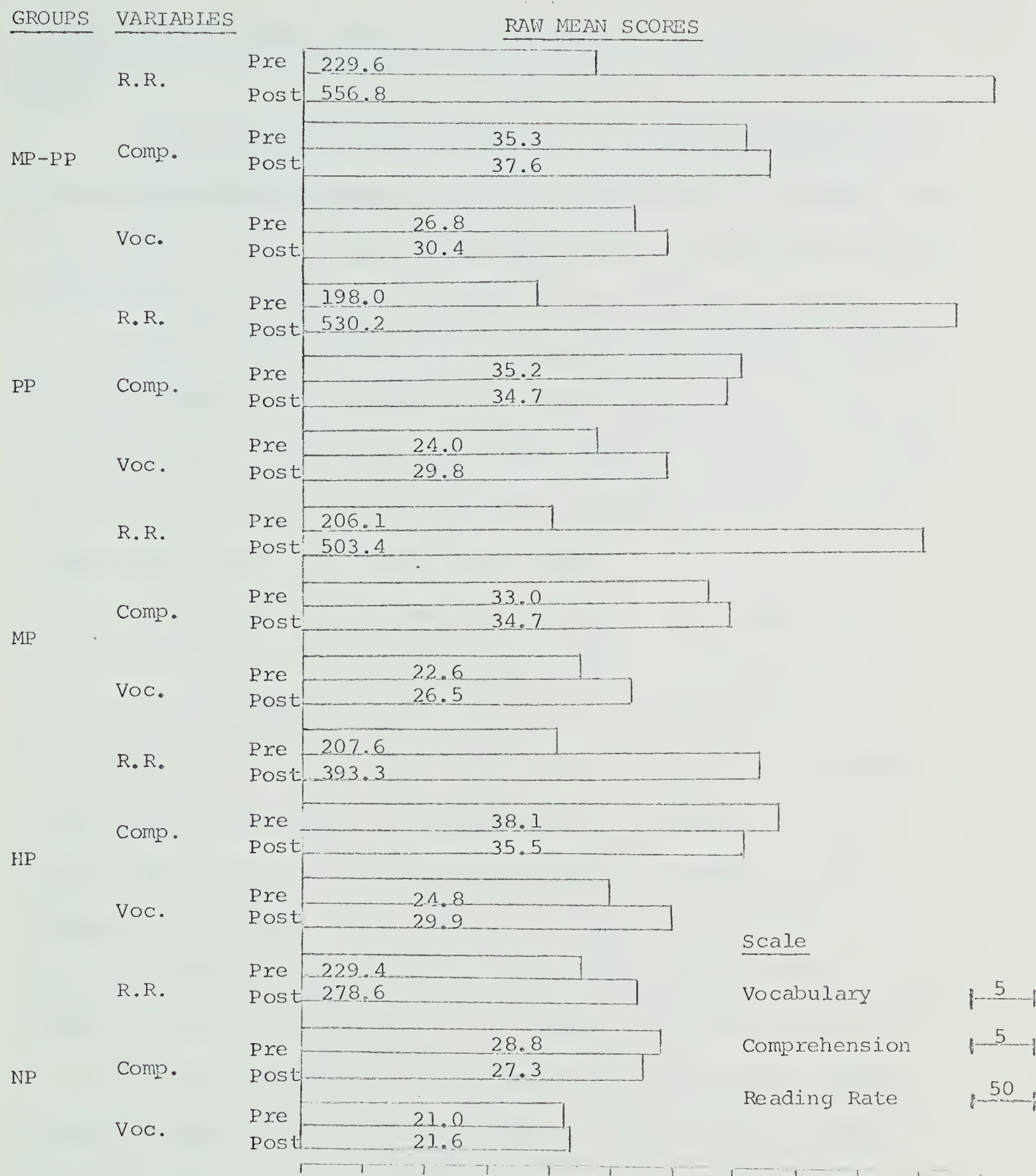


FIGURE 6

PRE AND POSTTEST RESULTS FOR VOCABULARY,
COMPREHENSION, AND READING RATE
FOR ALL GROUPS

and relaxation of the subjects (Clark, 1960; Start, 1960; Corbin, 1967).

Compared to the NP group, the MP, PP, and MP-PP treatments were equally effective and showed a significant improvement in reading rate. The HP group showed an improvement from pretest to posttest in reading rate, but was not significantly better than the NP group. (Figure 6)

The greatest difference between groups was found when the reading rate variable was measured. The groups are placed in an ascending order according to their mean rates as follows: NP, HP, MP, PP, and MP-PP. That the MP-PP group would show the greatest gain has also been documented by Clark (1960) and Jones (1964).

The MP group did not show any significant improvement over the NP group when tested on the vocabulary variable. Since most of the drills were practiced with eyes closed and were performed mentally, this finding is not surprising. The HP, PP, and MP-PP groups showed a significant improvement in vocabulary over the NP group. The HP group showed a positive increase from pretest to posttest for both vocabulary and reading rate. The use of a hand as a pacer was surprisingly effective and this group's performance exceeded expectations. Figure 6 shows this graphically. For reading rate the PP and the MP-PP group showed a significant improvement over the HP group. The MP group was very close to being significantly better ($t = 1.92$; when t ratio of $2.00 = .05$ level of significance) when compared to the HP group. The HP group performance was not significantly better than the NP group when measured on the reading rate variable. The HP group was introduced to isolate the use of the hand as a pacer and no

improvement was expected for this group. However, the rate of gain for this group was in a positive direction.

As expected the NP group showed only small improvement in all three variables from pretest to posttest results.

Implications

It was the aim of the experiment to test the effects on learning through mentally practicing a skill for a greater length of time. The results indicate that the subjects derived a certain amount of benefit from using this method. These benefits could center around learning-process issues. Among these could be improved confidence, increased relaxation, additional analysis of the task and thus improved organization of actions, and increased concentration.

It is felt that most action requires a certain amount of mental practice before, during and after performance of a task. This seems to be the case in a sports activity as previous research has shown, or an academic activity such as reading as has been shown in this study. Increased familiarity with the reading skills can result in a higher performance rate. The experiment showed that time spent in mental practice enhanced learning of rapid reading skills.

Reading is probably the most important skill to be learned in order to insure further academic success. Since reading rate improved significantly in this study through the use of MP, the implications for allowing time for MP in learning of reading skills seems evident.

Suggestions for Further Research

It was difficult to regulate the MP factor. The group members could easily have practiced on their own, although they were asked not to. Further research is needed by designing simple experiments in which the MP factor can be controlled under laboratory conditions.

There is a need for studies which would look at pre, post, and follow-up results in trying to establish the effectiveness of MP.

Because of the length of the study it was impossible to prevent subjects of the five groups from exchanging experiences. One suggestion may be to choose each group from a different school.

Studies comparing individual scores instead of group results would be of interest.

The carry-over effect of mental practice of a skill to learning other skills could be explored.

Previous studies showed that intelligence or sex did not play a major role when mental practice was used in the learning of a motor skill. Since the skill learned in this study differed from the previous skills used in studies of MP, it would be of interest to investigate if intelligence or sex of the subjects influences the results.

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APPENDIX

RAW DATA OF GROUP 1 - NP

I .D. NO.	SEX	PRE VOC.	POST VOC.	PRE COMP.	POST COMP.	PRE READING RATE	POST READING RATE
1	F	18	18	24	26	304	299
2	F	17	22	24	24	318	299
3	M	13	23	34	44	216	290
4	F	23	25	22	32	216	269
5	F	14	19	36	30	287	344
6	M	17	13	28	18	174	309
7	F	28	21	14	22	262	235
8	M	23	28	30	30	207	203
9	F	20	18	34	22	226	290
10	F	25	27	30	42	207	257
11	F	13	16	28	12	150	165
12	M	19	23	26	22	371	333
13	M	25	21	34	22	174	177
14	F	17	16	30	26	216	203
15	M	29	26	36	34	226	499
16	M	27	17	28	22	185	245
17	F	29	34	32	36	161	319

RAW DATA OF GROUP 2 - HP

I.D. NO.	SEX	PRE VOC.	POST VOC.	PRE COMP.	POST COMP.	PRE READING RATE	POST READING RATE
1	M	18	25	28	16	150	413
2	M	27	30	48	46	226	356
3	F	50	52	50	48	318	615
4	M	30	35	40	38	226	615
5	M	18	27	24	32	226	475
6	M	25	28	54	34	161	279
7	M	23	25	46	34	185	403
8	F	19	17	16	22	161	235
9	F	16	25	42	40	161	188
10	M	30	30	50	46	262	488
11	F	7	9	12	10	185	290
12	F	38	45	46	56	216	299
13	M	36	49	38	32	226	356
14	F	16	23	34	36	216	379
15	M	28	34	42	46	207	413
16	F	16	25	40	32	195	488

RAW DATA FOR GROUP 3 - PP

I.D. NO	SEX	PRE VOC.	POST VOC.	PRE COMP.	POST COMP.	PRE READING RATE	POST READING RATE
1	F	28	32	42	30	275	573
2	M	10	22	36	42	174	615
3	M	34	25	12	16	104	561
4	M	11	22	20	28	226	670
5	F	26	38	40	46	216	573
6	F	14	24	28	22	216	299
7	M	21	25	34	38	161	356
8	F	20	32	34	28	238	573
9	M	33	35	38	36	161	599
10	M	32	44	38	44	161	368
11	F	25	32	50	46	262	740
12	M	9	11	22	24	115	356
13	M	25	27	38	24	207	740
14	F	31	36	46	42	238	369
15	F	41	42	50	54	216	561

RAW DATA FOR GROUP 4 - MP

I.D. NO.	SEX	PRE VOC.	POST VOC.	PRE COMP.	POST COMP.	PRE READING RATE	POST READING RATE
1	F	37	47	52	54	327	599
2	F	22	26	36	40	262	670
3	M	18	22	16	34	318	586
4	F	15	19	30	40	262	820
5	M	19	28	22	30	128	511
6	F	27	31	38	36	174	257
7	M	20	20	28	32	128	475
8	F	12	12	40	24	94	257
9	F	16	18	30	28	275	499
10	M	18	28	32	32	216	450
11	M	31	26	30	32	94	195
12	M	27	30	42	32	216	740
13	F	35	42	44	52	207	670
14	M	19	22	22	20	185	319

RAW DATA FOR GROUP 5 - MP-PP

I.D. NO.	SEX	PRE VOC.	POST VOC.	PRE COMP.	POST COMP.	PRE READING RATE	PRE READING RATE
1	M	19	24	24	34	174	368
2	F	22	23	22	24	238	561
3	M	23	32	38	30	185	524
4	F	25	35	24	32	216	820
5	M	38	36	44	44	238	356
6	F	32	45	40	38	185	379
7	M	22	30	46	30	318	561
8	M	17	15	36	34	128	586
9	F	20	20	32	40	150	235
10	M	33	37	34	52	207	511
11	F	25	29	38	38	185	309
12	M	16	20	28	22	161	820
13	M	38	32	36	48	349	740
14	M	45	48	52	60	480	1025

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